PRE-SCRIPT®
COACH'S
FIELD GUIDE
VOL.1
Re Repetition
Sy Stability
Wl walking lunge
V Volume
Dc dumbell curl
In Intensity
Lb low bar
PC power clean
Pp push press
Mb Mobility
Bp bench press
Fw free weights
Fr Frequency
Fl Failure
St Superset
St Strength
D deadlift
Ex Exertion
Rr renegade row
Gs goblet squat

Pre-Script® Coach's Field Guide

The Pre-Script ® Coach's Field Guide is a reference for trainers, coaches, and athletes to give them a better working understanding of the guiding principles that govern our training decisions.

This is NOT a step-by-step workout plan or a "10 easy steps to .."*

It's a concise, high-level explanation of key resistance training concepts and how they can be applied instantly to your training paradigm.

THESE CONCEPTS INCLUDE:

Resistance Profiles: Learn the unique properties of different training modalities, and how they affect the human body.

Strength Curves: Learn how muscles respond to resistance, and how we can predict a muscle's behaviour in certain positions.

Planes of Motion: Sagittal, Frontal and Transverse: Understand the key concepts of the "tri-planar model" and how movement is organized.

Exercise Indexing: Effective exercise indexing is the backbone of exercise selection- which becomes the biomechanical framework on which we build our exercise programs.

Whether you are new to the gym floor or an established veteran- these concepts are crucial in order to make better decisions around your training.

Vol 01

TAXONOMY

Did you know that cows are closer genetic relatives to blue whales than they are to horses?

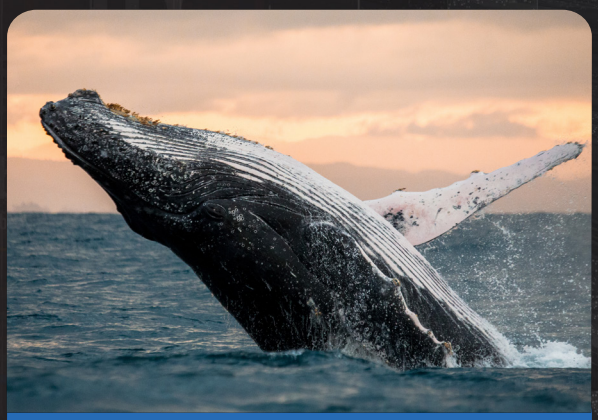
An abstract thought for most to grasp, but to a biologist who understands how the animal kingdom is categorized by Phylum, Subphylum, Class, Order, Infraorder, Family, Genus, Species etc. It becomes a relatively straight line to draw from their common ancestors.

(For the record, whales stem from the same order- Artiodactyla and their common ancestor lived roughly 60 million years ago.)

COWS

Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Artiodactyla
Family: Bovidae
Subfamily: Bovinae
Genus: Bos
Species: B. taurus

WHALES



Kingdom: Animalia
Phylum: Chordata
Class: Mammalia
Order: Artiodactyla
Infraorder: Cetacea
Family: Balaenopteridae
Genus: Balaenoptera
Species: B. musculus

This system of categorization is called **taxonomy.**

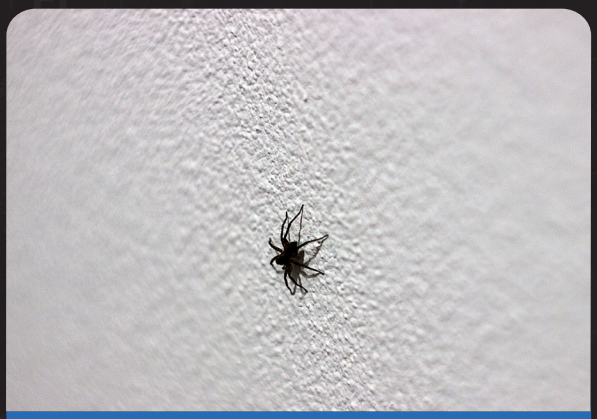
Taxonomy is a subset of scientific categorization that is often used in the organization of organisms and animals, but its high-level concept can be transferred across disciplines to exercise science in a very meaningful way.

Using a system with this level of granular detail becomes infinitely useful, as the layers of detail will ultimately change the way we act when interacting with animals. This makes taxonomy more than just a theoretical hierarchy but a practical guide for approaching animals.

Let's think for a second about a spider. Now, depending on your experience, you could be thinking of either a common house spider or a Sydney funnel-web spider. However, that represents a wide and potentially fatal range of outcomes.

A common house spider, also known as **Parasteatoda Tepidariorum**, and the Sydney funnel-web spider, also known as **Atrax Robustus**, are organized under the exact same kingdom, phylum, subphylum, class, and order, differing only at the levels of infraorder, family, genus, and species.

COMMON HOUSE SPIDER



Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Chelicerata
Class: Arachnida
Order: Araneae
Infraorder: Araneomorphae
Family: Theridiidae
Genus: Parasteatoda
Species: P. tepidariorum

SYDNEY FUNNEL-WEB SPIDER

Kingdom: Animalia
Phylum: Arthropoda
Subphylum: Chelicerata
Class: Arachnida
Order: Araneae
Infraorder: Mygalomorphae
Family: Atracidae
Genus: Atrax
Species: A. robustus

A bite from a Sydney funnel-web spider can lead to nausea, vomiting, coma, or even death, whereas a bite from a common house spider is unlikely to have any negative side effects.

If you come across a Sydney Funnel-Web spider, it is advisable to avoid contact at all costs. However, there is a common house spider that lives next to my toilet.

The key takeaway here is that the meaningful differences that incite a change in action only occur at a certain depth of analysis.

Now let's talk fitness things…

When it comes to resistance training, there are only a few widely accepted and widely applied criteria. However, this superficial system often fails to provide enough depth to bring about meaningful changes in our actions.

The purpose of the field guide will be to highlight a few common systems of exercise categorization and provide underlying principles that will add depth to our exercise taxonomy system, enabling us to make better decisions in our training.

MUSCLE GROUP

The highest level of taxonomy and categorization is based on muscle groups. From a young age, we were introduced to the basic understanding of muscular anatomy, forming the foundation of our training framework, such as "Pecs," "Lats," "Quads," "Biceps," and so on.

This categorization serves as the primary schematic for resistance training and is relatively simple to grasp in theory. However, there are subtleties in exercise execution that help bias certain muscles over others. We will delve into those details in future volumes of The Coaches Field Guide.

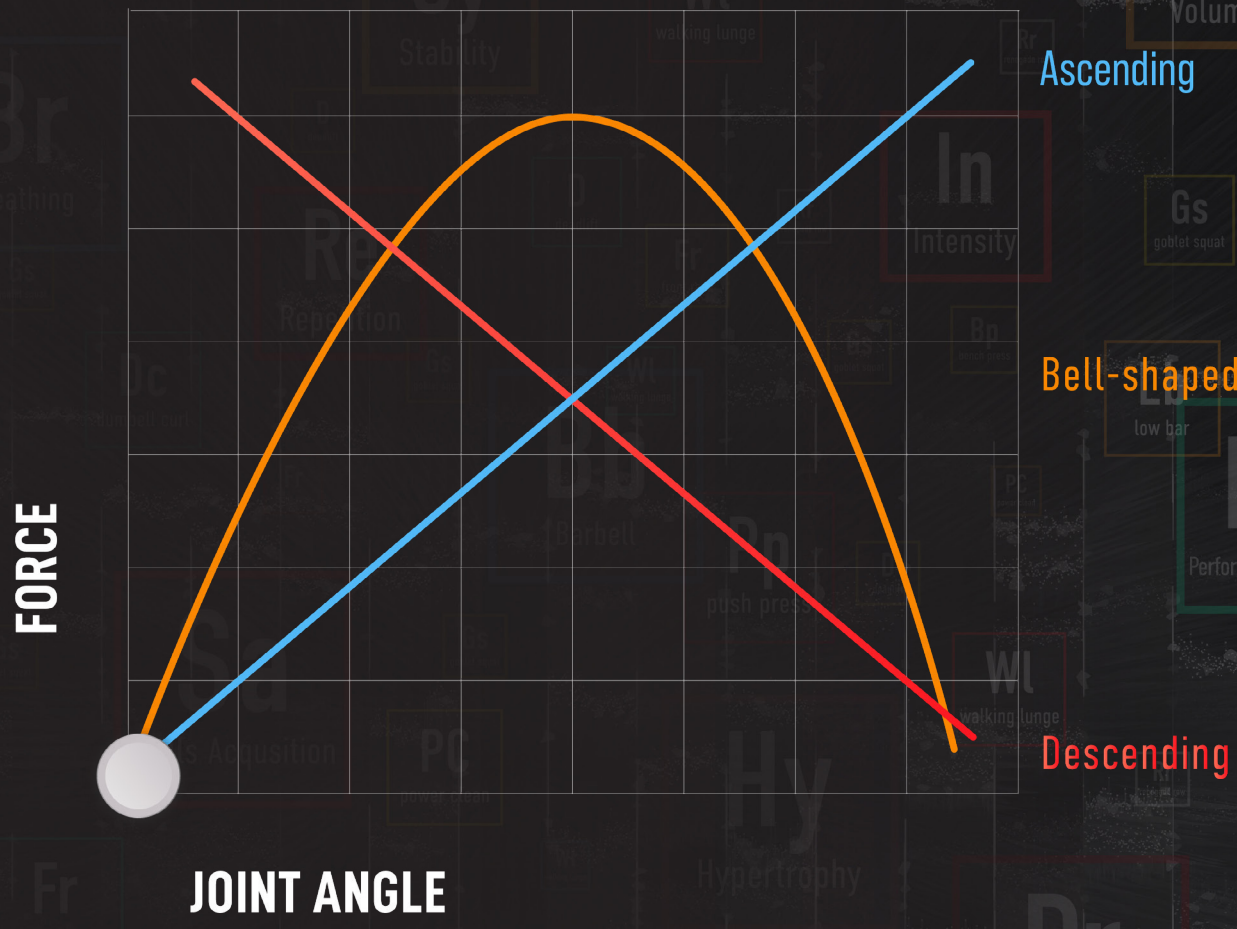
For now, let's focus on high-level concepts that apply to all muscle groups and help us understand certain properties of muscles that can influence how we approach training them.

One crucial property of a muscle that impacts our training decisions is its "length-tension relationship."

Length-Tension Relationship

The length-tension relationship helps us predict the positions in which a muscle is more or less capable of producing force. This key principle enables us to make the best decisions regarding which exercises to use for training a muscle most effectively.

To gain a better understanding of what the length-tension relationship is and how it becomes useful in our training, let's examine a strength curve, also known as a strength profile. It is simply a graphical representation of a muscles ability to exert force across its anatomical length.


Ascending
Bell-shaped
Descending
FORCE
JOINT ANGLE

This bell curve demonstrates that as a muscle approaches its respective lengthened and shortened positions, its ability to exert force diminishes slightly more in the shortened position than in the lengthened position. At the muscle's "mid-range," it exhibits the greatest ability to exert force. It is valuable to identify these positions for each muscle group that you train. This allows you to subcategorize exercises based on the loadability of these positions.

Let's take a look at an example together...

The Biceps Brachii is a biarticular muscle group, meaning it crosses two joints—the elbow and the shoulder. It inserts on the radial tuberosity via the bicipital aponeurosis and spans up to its two origins at the coracoid process (short head) and supraglenoid tubercle (long head).

The biceps act to create supination at the wrist, flexion at the elbow, and flexion at the shoulder. Once we understand its anatomical structure, we can begin to identify which positions constitute "lengthened," "mid-range," and "shortened" positions and assign exercises accordingly.

Lengthened: Low Cable Bicep Curl

Mid Range: Seated Preacher Curl

Shortened: High Cable Bicep Curl

Each of these positions will have a different maximum loadability based on its length-tension relationship. Understanding the relative glass ceilings of load between exercises and their respective positions will enable us to make informed decisions in exercise selection while factoring in the recovery needs.

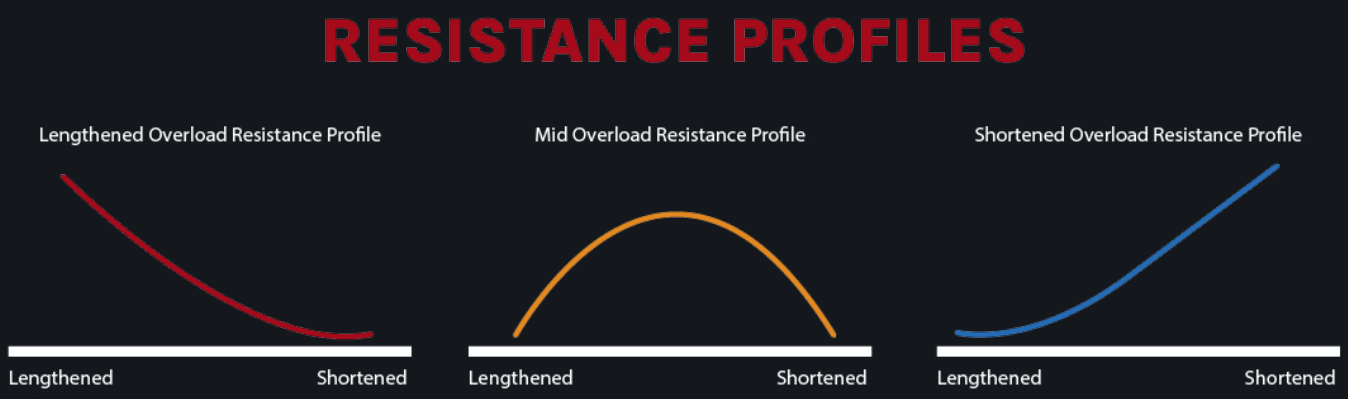
MODALITY

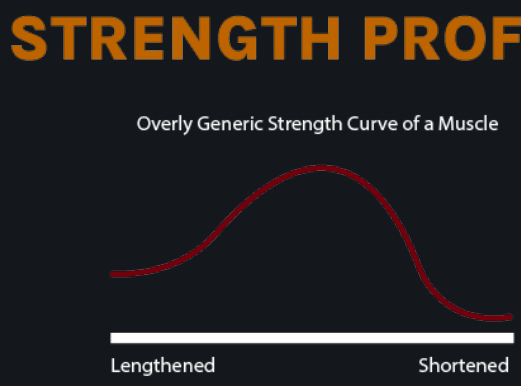
Once we have considered the muscle and its activity, it's time to subcategorize our exercises based on what happens to the muscle. One of the major factors that determine the stimulus and adaptations we achieve is the modality we use to add resistance to the muscle.

Modalities can be classified as Kettlebell, Dumbbell, Barbell, Cable, Pin-Loaded Machine, Plate-Loaded Machine, and so on. Each modality offers its own set of benefits, often scaled on a spectrum from less to more stable. Kettlebells and dumbbells are the least stable, while plate/pin-loaded machines are the most stable.

Resistance Profile

Just as muscles have a predictive model for anticipating their ability to produce force at various positions (Strength Curve), modalities also have a predictive model for how they exert force on us at different positions (Resistance Profile).





Resistance profiles allow us to understand where during a movement, a modality is exerting more or less force on us.

This principle is easiest explained by breaking down resistance profiles into their two major use cases

1. Free Weights (including plate-loaded machines)
2. Cable Machines

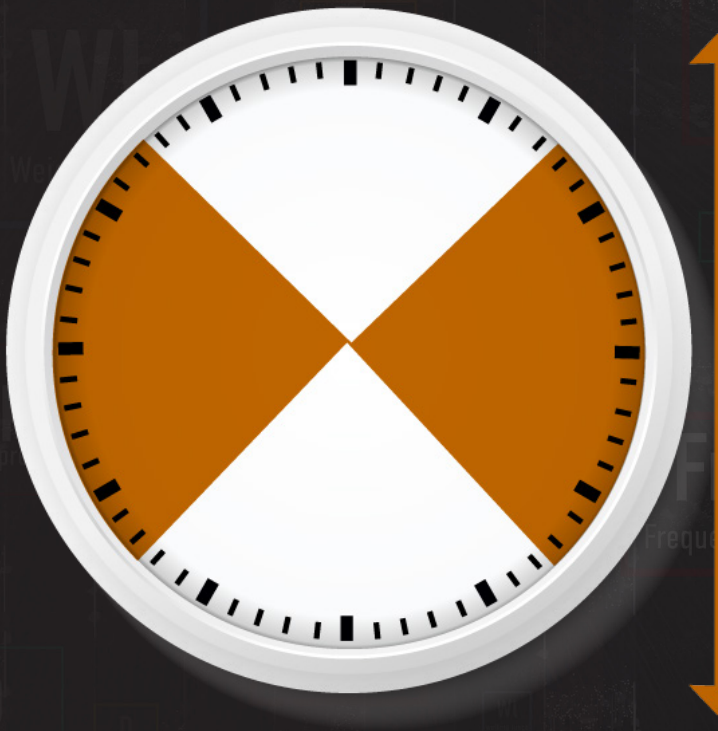
When examining any free-weight movement (including plate-loaded machines), we first need to observe the arc in every movement. Each movement follows an arc, from a dumbbell lateral raise to a bicep curl to a pendulum squat.

Once we identify the arc, we need to place it within a full circle of potential movement from the central point.

This allows us to understand which parts of the movement have a disproportionately horizontal or vertical component.

Think of a watch face…

The top of the watch face is 12, the bottom is 6, and the sides are 3 and 9. When movements occur between 1:30 and 4:30 and 10:30 and 7:30, free weights will travel more vertically than horizontally. The peak vertical displacement occurs at 3:00 and 9:00, respectively. This can be referred to as "HEAVY O'CLOCK."



Vertical Displacement

It goes without saying (but we'll state it for the record), our interest will peak as we move through ranges of predominantly vertical displacement because that's where gravity exerts the maximum potential force of the weight onto the body. Conversely, when movement occurs between 10:30 and 1:30 and 4:30 and 7:30, the weight travels more horizontally than vertically. The peak horizontal placement occurs at 12 and 6, respectively.

Since gravity doesn't pull sideways, it will always be easier to move free weights between 10:30 and 1:30 and 4:30 and 7:30. This can be referred to as "LIGHT O'CLOCK."

Now, let's apply this to exercise terms...

For this example, let's consider a dumbbell lateral raise and superimpose the movement over a watch face to predict where there is the greatest amount of vertical displacement and where there is the greatest amount of horizontal displacement.

Horizontal Displacement

First, let's identify the center point of the watch face. For the dumbbell lateral raise, the shoulder joint is the center, and the movement would occur between 6:00 and 3:00 (roughly).

This means the initial movement of the dumbbell lateral raise is horizontal, and the second half of the movement is more vertical. Now, understand that the dumbbell (and any free weight) will naturally want to travel straight down due to gravity.

The dumbbell exerts the greatest force on the deltoid as it moves to 3 o'clock or 9 o'clock.

If we consider the strength curve of the deltoid, we'll note that 90 degrees of shoulder abduction approaches the shortened position of the deltoid, where we would anticipate a drop-off in the ability to exert force.

So roughly speaking, the dumbbell is at "heavy o'clock" as the deltoid becomes weaker. This mismatch in loading is not necessarily good or bad; it just needs to be understood when it's present, as it also imposes a limit on the ability to load the muscle maximally. There are many layers to this conversation that will be discussed in future Coaches Field Guides.

Now, let's take the same example of the deltoid and examine how a machine exerts force.

A run-of-the-mill shoulder lateral raise machine is perhaps one of the most universally accepted designs when it comes to machine manufacturing. The reason for its widespread use is that it's easy to create a cam* to correct for the force mismatch of the dumbbell lateral raise.

A cam is a projection on a rotating part in machinery, designed to make sliding contact with another part while rotating and impart reciprocal or variable motion.

The cam design allows the machine's tension to be lower in the lengthened and shortened positions, where we are "weaker," and apply a greater amount of tension in the mid-range where we are "stronger."

MUSCLE GROUP AND MODALITY: CONCLUSION

Imagine this scenario in your mind:

It's 5 pm on a Monday evening, and you're at a commercial gym witnessing a personal trainer working with a client. They head over to the seated hamstring curl machine, but to their disappointment, it's already occupied. Thinking quickly, the trainer spots a vacant lying hamstring curl machine next to it and decides to make a real-time substitution.

At first glance, based on the basic principles of muscle group and modality taxonomy, this substitution may seem acceptable.

However, if we examine it more closely from a mechanistic perspective and analyze the occupied seated hamstring curl machine through the lens of the length-tension relationship, we can see how these two exercises actually provide quite different and even opposite stimuli to the hamstring muscles. The seated hamstring curl primarily targets the muscle in its lengthened position, while the lying hamstring curl focuses on the shortened position.

Under this categorization system, if our goal is to maintain consistency in stimulating the lengthened range of the hamstring, a more suitable substitution would be a Romanian deadlift (using a barbell or dumbbells), as it better replicates the body position and subsequent hamstring stimulus provided by the seated hamstring curl.

In a similar comparison, if we were farmers in a field, we might assume that a horse and a cow share more similarities than a cow and a whale. After all, the whale lives in water…

Trainers often look at the muscle group and the modality and choose the other hamstring machine instead of the Romanian deadlift because the dumbbells are located in a different section of the gym.

However, a subtle shift in the reference point of our analysis can have a profound impact on how we approach our training.

PLANES OF MOTION

Another beneficial system of categorization (yes, it's a word—I just checked on Google) is understanding the three cardinal planes of movement: Sagittal, Frontal, and Transverse planes. Organizing movements based on their bias toward a particular plane can be useful. Furthermore, understanding the muscles that primarily work in each plane can also be helpful.

For those unfamiliar with these terms, fear not. They can be tricky to grasp at first, but we'll provide enough examples of exercises in each plane that you'll become a pro by the end.

THE SAGITTAL PLANE

The sagittal plane refers to the body's movement through flexion and extension, whether it's the shoulder, elbow, ankle, etc.

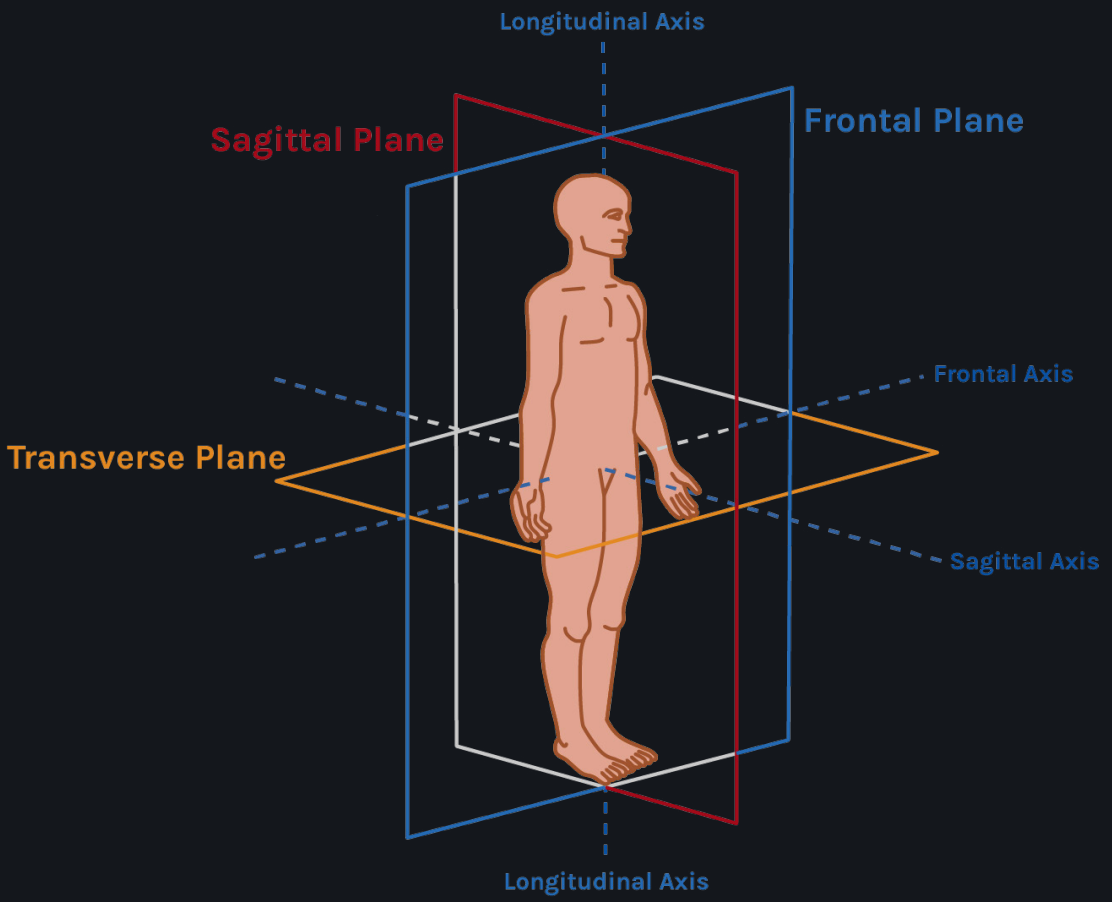
THE FRONTAL PLANE

The frontal plane refers to the body's movement through abduction/adduction. In the case of the trunk, this can also be referred to as "lateral flexion."

THE TRANSVERSE PLANE

The transverse plane refers to the body's movement through rotation.

In isolation and in theory, these definitions are fairly straightforward and easy to follow. However, some complexity is needed to understand how to apply this theory in practice.



PLANES IN MOTION

We must remember two major governing principles when looking at movement through the lens of planes of movement. The first is an understanding of the hierarchical ordering of the individual planes, and the second is the ever-present interaction of these planes.

1. Planar Movement Hierarchy

Firstly, we need to understand how these planes of movement are organized in our brains from easiest to most complex.

The sagittal plane is the simplest to move through and, in some ways, can be considered our default state. Moving a joint or region of the body through the movements of flexion and extension requires less input and provides more support than the other two planes. It is because of this simplicity that the sagittal plane becomes our default.

Slightly more complex is the frontal plane. Moving side-to-side can pose challenges when compared to the flexion and extension movements of the sagittal plane, but it is easier to coordinate than the transverse plane.

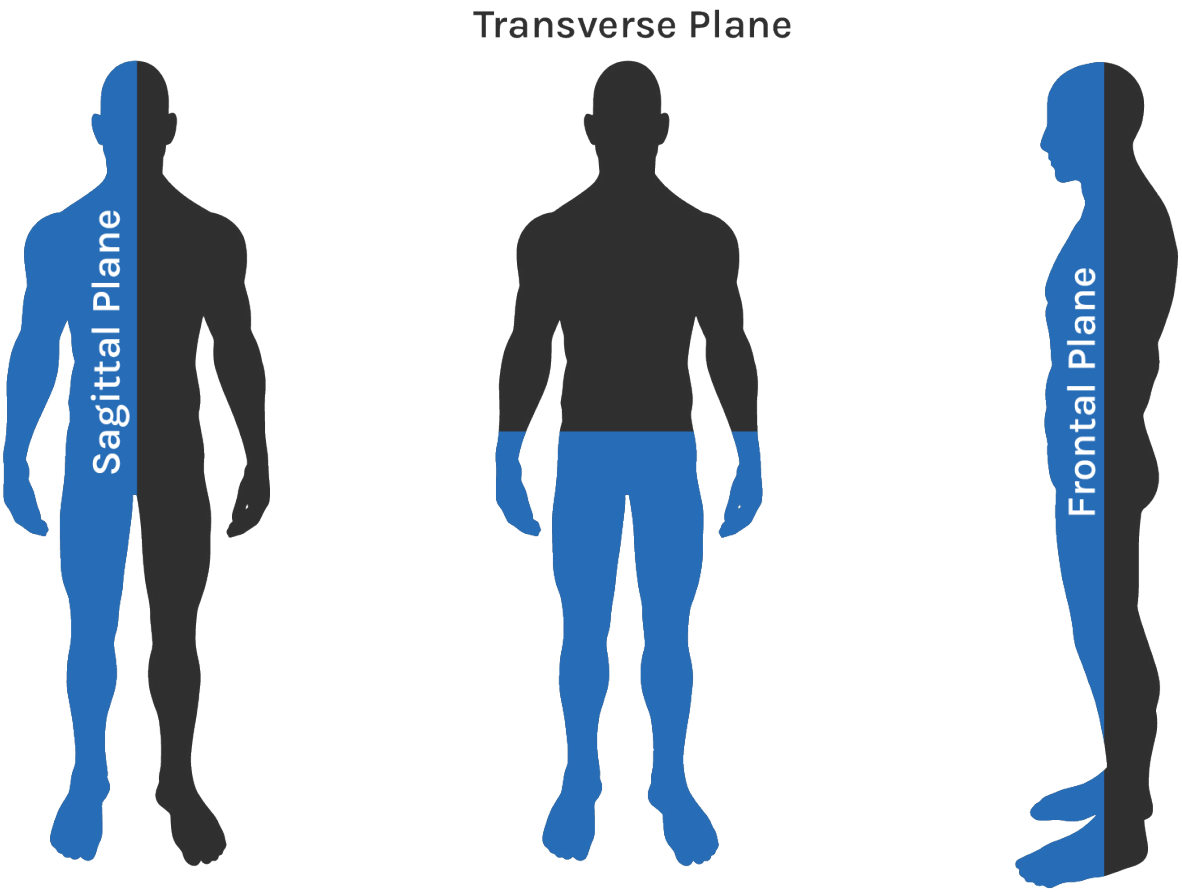
And finally, the transverse plane—rotational movements—are the most difficult to initiate and coordinate effectively.

When you understand this sequence of movement from “front-to-back,” “side-to-side,” and “rotation,” you start to see it EVERYWHERE.

From the most basic uninitiated novice gym-goers’ intuitive warm-up of:

Forward and back leg swings,
Lateral leg swings,
Trunk rotations before starting a leg workout.
To Olympic swimmers preparing for the gold medal final by doing:

Forward and back arm circles,
Side-to-side arm swings,
Trunk and cervical spine rotations before getting on the starting blocks.
To NFL running backs running in a straight line until they run out of options, then side-stepping until they run out of options, and ultimately rotating as a last resort to avoid being tackled.



There are numerous applications for understanding how the three planes interact with one another and how the human body adjusts its movement capabilities according to each plane.

This principle can be used as an assessment tool to determine whether individuals have the passive flexibility or active mobility to successfully move into each plane before introducing any type of load.

It can also be used to create motor learning progressions for novice clients or as part of a progression model for those looking to rehabilitate after an injury or surgery.

2. Planes of Movement: Interaction

The second governing principle for effectively applying logic backed by an understanding of the planes of movement is the recognition of the ever-present nature of movement through all three planes.

There will commonly be cases where the movements we train cannot be simply classified as entirely sagittal, frontal, or transverse. We must accept that these three planes are accessed synergistically to create movement. That being said, it's still useful to determine which plane a movement biases more than another while recognizing how the other planes interact behind the scenes.

Let's take the dumbbell front raise as an example. It is an exercise that often falls under the category of anterior deltoid exercises. This can also be seen as a sagittal plane shoulder movement because its primary function involves resisted flexion of the shoulder. However, it would be beneficial to understand the amount of transverse plane movement present as well.

Let's assume an average dumbbell front raise goes through 90 degrees of shoulder flexion. What we may not notice is that the dumbbell front raise also involves 90 degrees of shoulder rotation, and this concept can be challenging to grasp for some.

So let's break it down.

Typically, when we think of 90 degrees of shoulder rotation, we imagine exercises using bands or cables that apply load through the transverse plane, specifically targeting the rotator cuff.

However, if we pay attention to the arm path during the dumbbell front raise, we observe that the shoulder starts from a relatively externally rotated position at the bottom of the movement, indicated by the palms facing the side of the body. At the end of the movement (90 degrees of flexion), the palm now faces the floor. So if we consider the hand as a proxy for shoulder rotation, we can see that 90 degrees of rotation has occurred.

Although the rotation isn't resisted to the same degree as the shoulder flexion due to the dumbbell loading primarily in the sagittal plane, it still occurs and is important. This integration of muscle function should be considered rather than isolating muscle action. With all of this in mind, we can expand upon a surface-level taxonomy for the dumbbell front raise, which would have previously been classified solely as an anterior deltoid-biased dumbbell exercise (highlighting muscle and modality).

We can now include it as a sagittal plane shoulder exercise with the integration of transverse plane rotator cuff function.

When searching for exercises with different, more specific reference points, we can see the utility of the dumbbell front raise beyond its narrow search criteria of "anterior deltoid exercise."

If we now search our index for "sagittal plane shoulder exercise" or "rotator cuff integration exercise," our taxonomy system will identify the dumbbell front raise as a potential result.

The goal is to understand movement at a mechanistic level and, from there, be able to extrapolate countless "references" or "categories" within our taxonomy structure of movement.

MECHANISMS

It's imperative that we keep those two keys in mind when attempting to identify mechanisms.

My dog thinks that barking opens doors. (I swear this has to do with exercise, stay with me)

When I got Axel at 8 weeks old, we both had the WORST separation anxiety. Every time I would leave the house, he would bark, and I would come rushing back. And after a while, he learned that if he barked, the door would open.

We can look at this and easily say, "Silly dog, that's not how doors open—I know how doors open."

But do you, though?

If anyone has locked their keys out of their house, you will know that you have no idea how doors open. Because you need to call someone who does. Then, minutes later, a locksmith shows up and charges you 200 dollars to open your door with an icepick and a credit card. That guy knows how doors work. That guy understands mechanisms.

As trainers and coaches, we must strive to be locksmiths. Otherwise, we're left barking louder and longer, waiting for changes to occur that may never happen.

INDEXING

Understanding mechanisms is the fundamental component of understanding how to index exercises appropriately. Without mechanisms, exercises can get clumped together in too broad a context, making filtering your exercise library slow and ineffective.

Mechanisms act as our reference point for indexing exercises. Think of a phonebook, for example. The phone book uses multiple different references to easily index all the people and businesses in a particular city. The two major divisions are the yellow pages and the white pages. The yellow pages are for businesses, and the white pages are for people.

From there, businesses are broken down by type (in alphabetical order), and under each type of business, they are listed alphabetically. Similarly, people are ordered alphabetically by last name.

A similar system of indexing and organization can and should be applied to exercise. Instead of using alphabetical order to rank movements, we would use mechanisms as our reference points and then list movements based on a number of filtering criteria such as complexity, loadability, efficacy, etc.

Let's take a look at "core training" as an example. If we were to list all the exercises and classify them under the broad umbrella term of "core training," we would end up with hundreds, if not thousands, of exercises on that list.

How do you choose?

Imagine looking someone up in the phonebook without a refined system of categorization. You would waste countless hours flipping through the pages to find the person you're after, or you might give up and not call anyone.

These problems are commonly faced by trainers and athletes. They either waste a lot of time or are paralyzed by choice.

However, if we use filtering criteria and index core movements based on a common mechanism, we can quickly narrow down our search.

A classic example is Stuart McGill's Big Three exercises: The Curl Up, The Side Plank, and the Bird Dog.

These exercises themselves are not indexed, but they serve as placeholders for core movements that bias a particular plane of movement.

The Curl-Up can be categorized as a sagittal plane core movement. The Side Plank can be categorized as a transverse plane core movement. And the Bird Dog can be categorized as a transverse plane core movement.

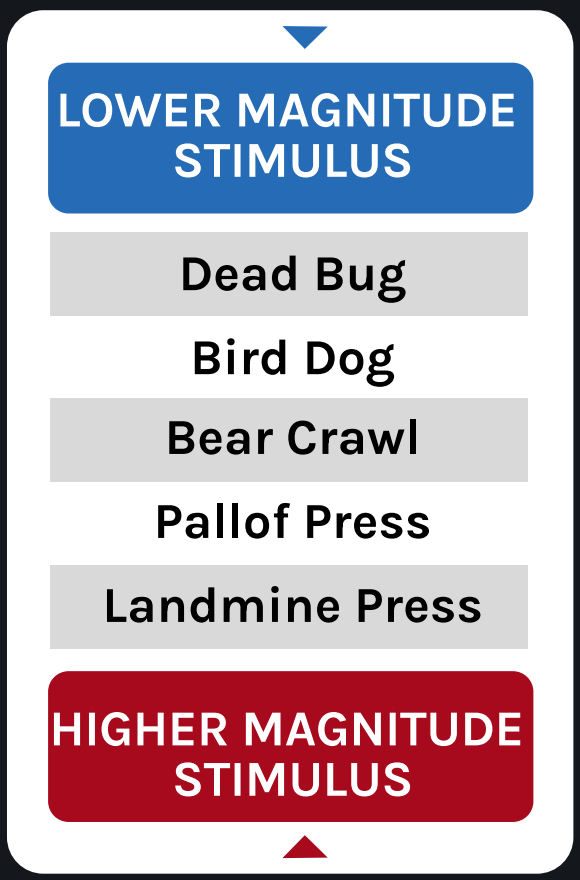
Using these categories, we can filter all core exercises and relate them to each other, creating a concise and easily "searchable" list of core movements. We can toggle between them based on a client's ability to perform more or less complex movements within that plane.

Let's take a closer look at the Bird Dog exercise, which is a staple movement and categorized as a transverse plane core exercise.

We can identify other core movements that filter out based on this criteria and relate them to the bird dog in terms of complexity, loadability, instability, etc.

Exercises like the Deadbug, Pallof press, Bear Crawl, and Landmine Press all share a similar "core" mechanism of being anti-rotation (aka transverse plane) drills, like the bird dog.

However, each exercise carries a significantly different magnitude of stimulus.
If we were to index the above-listed exercises by the magnitude of potential stimulus, our list would look something like this:



Now, this is only a cross-section of a massive list of transverse plane exercises. Depending on loading parameters, we could potentially change the order of a few exercises within the list. However, this provides us with a framework to establish where to begin with a client, rather than simply starting at the front of the book…

Let's use my last name, Shallow, as an analogy. It starts with the letter "S," which is the 19th letter of a 26-letter alphabet, making it 73% of the way through.

If you were to look me up in the phone book, would you turn to the front of the book?

I'd hope not…

You would do some quick mental math and likely flip to a page somewhere in the latter half of the book. And if you ended up in "T" or "U," you would flip back, and if you ended up in "Q" and "R," you would flip a few pages forward. This is how exercise selection should be.

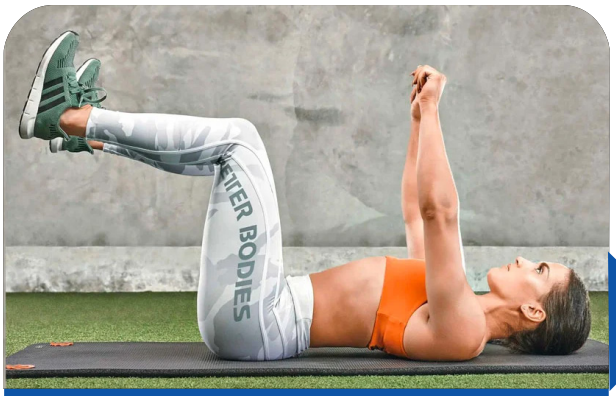
But too often, regardless of where people are, we are programmed to start at the front of the book. We follow a protocol that takes people through their literal "ABCs" of movement progression. On the surface, this might sound thorough, but in practice, it is a giant waste of time.

If we can create indexes of exercises based on mechanism, stimulus, and desired adaptation, and then assess our client's baseline level of ability to execute the movements, we can quickly "flip" through the pages and land in the ballpark of meaningful stimulus.

Creating these indexes allows us to accomplish two important things:

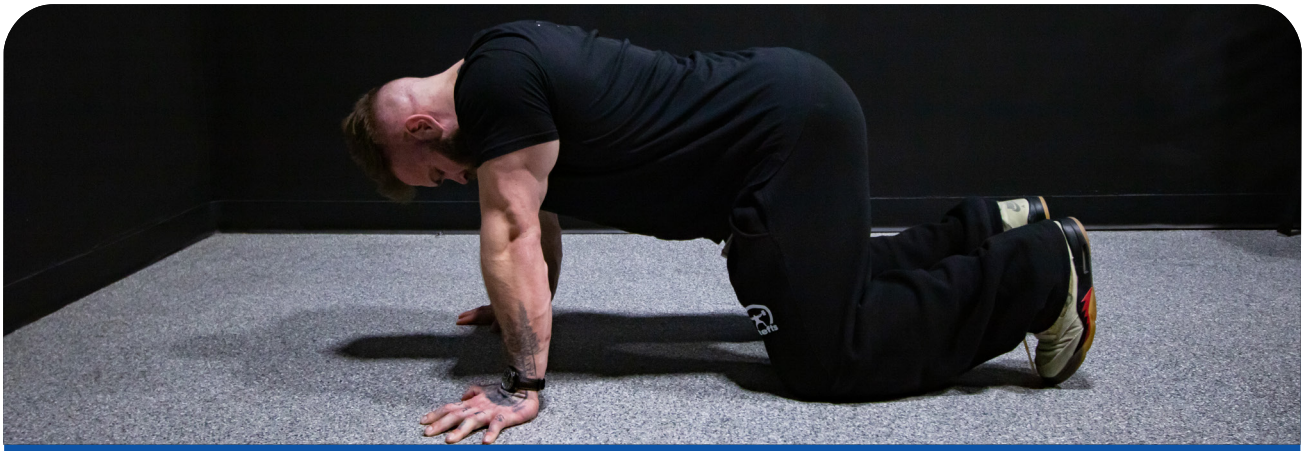
1. Rather than starting at page one, we can pinpoint exercises that match the specific needs of our clients. Broaden our use of exercises.

2. By indexing exercises based on various criteria, we expand our repertoire and provide more diverse and effective training options.

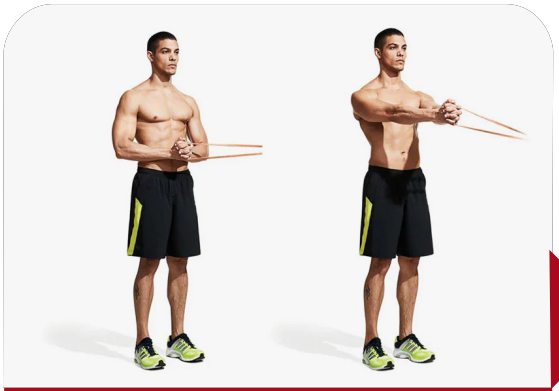


DEAD BUG

BIRD DOG



BEAR CRAWL



PALLOF PRESS

LANDMINE PRESS

EXERCISE SELECTION

The study of biomechanics can be simplified as the study of load management. However, load management doesn't simply involve going heavier or lighter on a particular movement or at a specific point in a training session or cycle. It entails the ability to control the loadability environment through the selection of exercises.

In essence, if we agree that biomechanics is load management and that the best way to manage load is by selecting exercises with appropriate loadability based on exercise constraints, then we can conclude that exercise selection is a crucial but often overlooked component of biomechanics.

Learning to index exercises based on mechanistic reference points allows us to quickly navigate through exercises that provide similar enough stimulus to suit the lifter's needs. It goes beyond just adjusting the load of a specific movement.

Now, let's break down the significance of indexing and exercise selection with an example.

There are two basic filtering criteria for improving the decisions we make around training are:

1. Time:
Does the exercise we select get us to the end goal faster?

2. Collateral:
Does the exercise we select carry with it any undesirable collateral, and if so, how much?

TIME

Some might argue, “Lat pull-downs don’t effectively target the lats.” This comment focuses on the biomechanics of the movement and the requirement for downward scapular rotation, which can be considered somewhat of an “upper back” movement. A better way to phrase this would be, “There are more effective ways to directly target or isolate the lat muscles from other back muscles.”

While it may be true that a single-arm cable row or a specific machine may have advantages in targeting the lat muscles more effectively, it doesn’t mean that the lat pull-down doesn’t work the lat muscles. It’s absurd to claim that it doesn’t since you are moving the arm on the spine, which engages the lat muscles.

So, if I have limited time or I want to efficiently stimulate my lats in isolation from other back muscles, the lat pull-down might not be my “go-to” exercis fulfill this goal. And a single arm cable lat pull-dow will be the move.

COLLATERAL

The second aspect to consider when understanding mechanisms is the potential collateral impact of utilizing a specific exercise to elicit a stimulus.

For instance, it has been said that “barbell rows are detrimental for hypertrophy,” which is not entirely true. People have been able to build significant muscle mass using this exercise for decades. It offers unique benefits, such as demanding muscular co-contraction due to the need to overcome substantial shear forces on the spine.

However, there is a significant portion of the population that lacks the necessary spinal control to manage these shear forces and the complexity of the movement. In such cases, the barbell row may not be as effective as a simpler, more direct (likely machine-based) movement for achieving the desired stimulus. It’s important to consider the potential effectiveness of alternative exercises. Complex movements may be unsuitable for some individuals, and opting for less shear-inducing exercises, such as a machine row, can be a better alternative.

Conclusion

Coaching is a multifaceted, ever evolving field constantly updating with new research and emerging trends. But through the breakthroughs and the novelty are immutable principles that will act as the cornerstone of our decision making process.

These principles aren't simple, they're sophisticated. However, having a working knowledge of how to apply these principles will make your decision making process simpler over time.

Length-tension relationships, resistance profiles, planes of movement, exercise indexing and exercise selection are but a few of the "basics" that coaches should familiarize themselves with in the pursuit of delivering a world class product to their clients and athletes.

In future field guides we'll dig deeper and expand wider across the theoretical landscape that better serves our practical application.

In the meantime, go forth and practice. Pracitce applying these principles in real-time to your decision making process, refining your craft and polishing your skills as a coach.